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*De Muth*

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): Maligeorgos, James  
Title: Voltage Controlled Quadrature Oscillator with Phase Tuning  
Serial No.: 09/776,392 Filing Date: 02/02/2001  
Examiner: Unassigned Group Art Unit: Unassigned  
Docket No.: M-12181 US

Austin, Texas  
September 26, 2001

COMMISSIONER FOR PATENTS  
Washington, D. C. 20231

**PRELIMINARY AMENDMENT**

Dear Sir:

Prior to examining this patent application, please enter the following amendments and consider the following remarks.

10/01/2001 TGEDAMU1 00000038 192386 09776392  
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**AMENDMENTS**

**In The Claims**

The following is a clean version of the entire set of pending claims. Those to which no amendment has been requested appear in small print.

1. An oscillator comprising at least two phase delay stages, each of said phase delay stages having an input for controlling the phase delay of the respective stage.

2. A regenerative frequency divider which includes the oscillator of claim 1.

3. An image reject mixer which includes the regenerative frequency divider of claim 2.

4. (NEW) An electronic circuit comprising:

a ring oscillator, the ring oscillator comprising a plurality of stages;

wherein at least one of the plurality of stages has an input for varying a phase delay of the at least one of the plurality of stages.

LAW OFFICES OF  
SKJERVEN MORRILL  
MACPHERSON LLP

25 METRO DRIVE  
SUITE 700  
SAN JOSE, CA 95110  
(408) 453-9200  
FAX (408) 453-7979

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5. (NEW) The electronic circuit as recited in Claim 4, further comprising:  
a current source coupled to the input.

6. (NEW) The electronic circuit as recited in Claim 5, wherein  
the current source comprises a transistor, and  
a base of the transistor is coupled to an input voltage to control an amount of current  
from the current source.

7. (NEW) The electronic circuit as recited in Claim 4, further comprising:  
a controllable capacitor coupled to the input.

8. (NEW) The electronic circuit as recited in Claim 4, further comprising:  
a controllable inductor coupled to the input.

9. (NEW) The electronic circuit as recited in Claim 4, further comprising:  
a controllable resistor coupled to the input.

10. (NEW) The electronic circuit as recited in Claim 4, wherein at least one of the  
plurality of stages comprises a differential amplifier.

11. (NEW) The electronic circuit as recited in Claim 10, wherein the differential  
amplifier comprises a plurality of emitter-coupled transistors.

12. (NEW) The electronic circuit as recited in Claim 4, further comprising:  
a second input coupled to the ring oscillator for receiving an input voltage having an  
input frequency causing the ring oscillator to have an oscillation frequency  
equal to half of the input frequency.

13. (NEW) The electronic circuit as recited in 12, wherein a phase shift calibrated  
at one input frequency does not need to be re-calibrated at a second input frequency.

LAW OFFICES OF  
SKJERVEN MORRILL  
MACPHERSON LLP

25 METRO DRIVE  
SUITE 700  
SAN JOSE, CA 95110  
(408) 453-9200  
FAX (408) 453-7979

14. (NEW) The electronic circuit as recited in Claim 4, wherein varying the phase delay is performed on two or more of the plurality of stages such that an oscillation frequency of the ring oscillator is not varied.

15. (NEW) The electronic circuit as recited in Claim 4, wherein:  
a first input of a first stage of the plurality of stages is differentially varied with respect to a second input of a second stage of the plurality of stages.

16. (NEW) The electronic circuit as recited in Claim 15, further comprising:  
a first current source coupled to the first input and a second current source coupled to the second input.

17. (NEW) The electronic circuit as recited in Claim 15, further comprising:  
a first controllable capacitor coupled to the first input and a second controllable capacitor coupled to the second input.

18. (NEW) The electronic circuit as recited in Claim 15, further comprising:  
a first controllable inductor coupled to the first input and a second controllable inductor coupled to the second input.

19. (NEW) The electronic circuit as recited in Claim 15, further comprising:  
a first controllable resistor coupled to the first input and a second controllable resistor coupled to the second input.

20. (NEW) A method of providing a multiple stage ring oscillator comprising:  
coupling two or more differential stages to form a ring oscillator; and  
varying the phase delay of at least one of the two or more differential stages.

21. (NEW) The method as recited in Claim 20, wherein the varying is performed  
by supplying a current source to an input of the at least one of the two or more differential stages.

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LAW OFFICES OF  
SKJERNEN MORRILL  
MACPHERSON LLP

25 METRO DRIVE  
SUITE 700  
SAN JOSE, CA 95110  
(408) 453-9200  
FAX (408) 453-7979



22. (NEW) The method as recited in Claim 20, wherein at least one of the two or more differential stages is a differential oscillator.

23. (NEW) The method as recited in Claim 20, wherein the varying the phase delay provides a capability of quadrature output phase error correction with a resolution of less than 1°.

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LAW OFFICES OF  
SKJERVEN MORRILL  
MACPHERSON LLP

25 METRO DRIVE  
SUITE 700  
SAN JOSE, CA 95110  
(408) 453-9200  
FAX (408) 453-7979